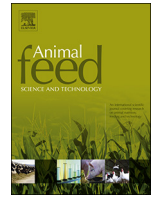




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Short communication

## Precaecal digestibility of crude protein and amino acids of a field bean (*Vicia faba* L.) and a field pea (*Pisum sativum* L.) variety for broilers

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## ABSTRACT

A linear regression approach was used to determine the precaecal digestibility of organic field beans and field peas in young broiler chickens. Diets with field beans of the variety Taifun (283 g crude protein/kg DM) and field peas of the variety Alvesta (173 g crude protein/kg DM) in three inclusion rates (30, 50, and 70%) were fed *ad libitum* to 15- to 21-day-old broiler chickens. Digesta was sampled pen-wise and obtained from the gastro-intestinal tract between 2005Meckel's diverticulum and 2 cm anterior to the ileo-caeco-colonic junction. Despite the high inclusion rates of the test feedstuffs, all diets were accepted by the birds. Feed intake and body mass gain, as well as precaecal crude protein and amino acid digestibility, were higher in chickens fed field bean diets than field pea diets. The precaecal crude protein digestibility of the tested field beans and field peas was 0.84 and 0.81, respectively. In comparison to lysine, methionine, histidine, and arginine, which were highly digestible at the terminal ileum, tryptophan was less digestible. The precaecal digestibility of crude protein and amino acids of the tested organic field beans and field peas is comparable to literature values for non-organic samples. In conclusion, compared to the literature the test results indicate that systematic differences between organic and non-organic samples do not exist. Field beans and field peas can serve as a suitable crude protein and amino acids source for broilers.

### 1. Introduction

High amounts of specific essential amino acids (AA) must be available for poultry (Zollitsch et al., 2004). Thus, the precaecal (pc) digestibility of crude protein (CP) and AA has become an important descriptor in feed evaluation for chickens (Ravindran et al., 1999). Since the estimation of endogenous losses is inaccurate (Donkoh and Moughan, 1999), it is more favourable to use approaches without a separate determination of endogenous losses for the evaluation of test feedstuffs. Linear regression approaches fulfil this condition and can be applied when at least three inclusion rates of the test feedstuffs to a basal diet are used (Short et al., 1999; Rodehutscord et al., 2004). Home-grown grain legumes, like field beans and field peas, can supply CP and some of the required AA for poultry. They are also advantageous in view of supporting regional agricultural production. This is important in organic farming, especially, where the sufficient supply with AA is difficult due to legal restrictions. The composition of field beans and field peas

Abbreviations: pc, precaecal; pcADC, apparent precaecal digestibility coefficient; pcSDC, standardised precaecal digestibility coefficient

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**Table 1**  
Analysed amounts of crude nutrients and amino acids (g/kg DM) in the test feedstuffs.

	Field bean ( <i>Vicia faba</i> L.)	Field pea ( <i>Pisum sativum</i> L.)
Variety	Taifun	Alvesta
Crude protein	283.3	173.5
Crude ash	57.3	33.3
Ether extract	18.6	22.6
Crude fibre	81.3	54.5
Lysine	18.73	13.96
Methionine	2.34	2.23
Cystine	3.87	3.49
Threonine	9.92	7.48
Tryptophan	2.06	1.42
Leucine	20.37	12.66
Isoleucine	10.97	7.33
Valine	12.21	8.26
Arginine	25.82	12.41
Histidine	8.77	5.14
Phenylalanine	12.08	8.87
Tyrosine	8.55	5.73
Alanine	11.56	8.06
Glycine	11.74	7.72
Serine	13.36	8.24
Proline	12.00	7.78
Aspartic acid	30.56	20.94
Glutamic acid	46.39	29.27

varies depending on variety and cultivation environment (Witten et al., 2015). Thus, even their pc digestibility may vary (Kluth et al., 2005a).

This study aimed to determine the pc CP and AA digestibility of a field bean variety and a field pea variety, commonly used in organic farming, in three-week-old broiler chickens.

## 2. Material and methods

The animal trial was carried out at the Research Farm for Agriculture “Unterer Lindenhof” of the University of Hohenheim (Stuttgart, Germany) according to the European Directive, 2010/63/EU and approved by local authorities.

As test feedstuffs, the field bean variety Taifun and the field pea variety Alvesta were cultivated in 2015 in Southern Germany (Hohenkammer GmbH, Gut Eichethof) according to current eco-directives (Table 1). In poultry feeding, varieties that are used are presumed to contain low contents of anti-nutritive factors. Taifun is a field bean variety that is advertised as tannin-free and is available in organic quality. The field pea variety Alvesta, which is high-yielding and used throughout Germany, is white-flowering and, therefore, also low in tannin.

### 2.1. Animals and housing

Day-old Hubbard ISA JA 757 mixed-sex broilers, which are commonly used in organic farming, were obtained from Couvoirs de L’Est hatchery in France. The chicks were randomly allocated to cleaned and disinfected pens and housed in groups on wood shavings. The size of the pens was 2.25 m<sup>2</sup> permitting a maximum of 5 kg body mass per m<sup>2</sup> and 0.125 m<sup>2</sup> floor space per broiler at day 21. The room was thermostatically controlled with an initial temperature of 32 °C that was decreased continually to 26 °C on day 21. For the first three days, the room was illuminated all day using artificial LED light with a light intensity of more than 20 lx. From day four, eight hours of darkness and 16 h of illumination time were applied. The chicks were vaccinated against Newcastle disease via drinking water and controlled twice daily. Feed and water were provided *ad libitum*. Prior to the trial period, which began on day 14, birds were fed with a starter diet (Table 2). The diet was formulated to meet nutrient requirements according to GfE (1999).

On day 14, broilers were weighed and, if necessary, exchanged between pens to achieve similar average body mass across all pens. The overall initial body mass was 352.8 g. Groups were then assigned to trial diets. Each trial diet was fed to 17 or 18 birds in six replicate pens for one week from day 15 to day 21 of life. Feed intake was determined. On day 21, all broilers were killed pen-wise by asphyxiation with carbon dioxide. To ensure gut fill, birds were fed for a minimum of 30 min prior to killing. After killing, the carcasses were weighed, and the ileal section of the gut was immediately gathered and examined for anomalies. The terminal two-thirds of the ileal section between Meckel’s diverticulum and 2 cm anterior to the ileo-caeco-colonic junction were excised (Kluth et al., 2005b) and cut into short segments. The digesta was flushed out gently with distilled water and pooled pen-wise.

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